

# DOE Annual HEP Program Review

## Physics Department Overview

Sam Aronson  
Physics Dept.  
2003

Chair,  
April 22,

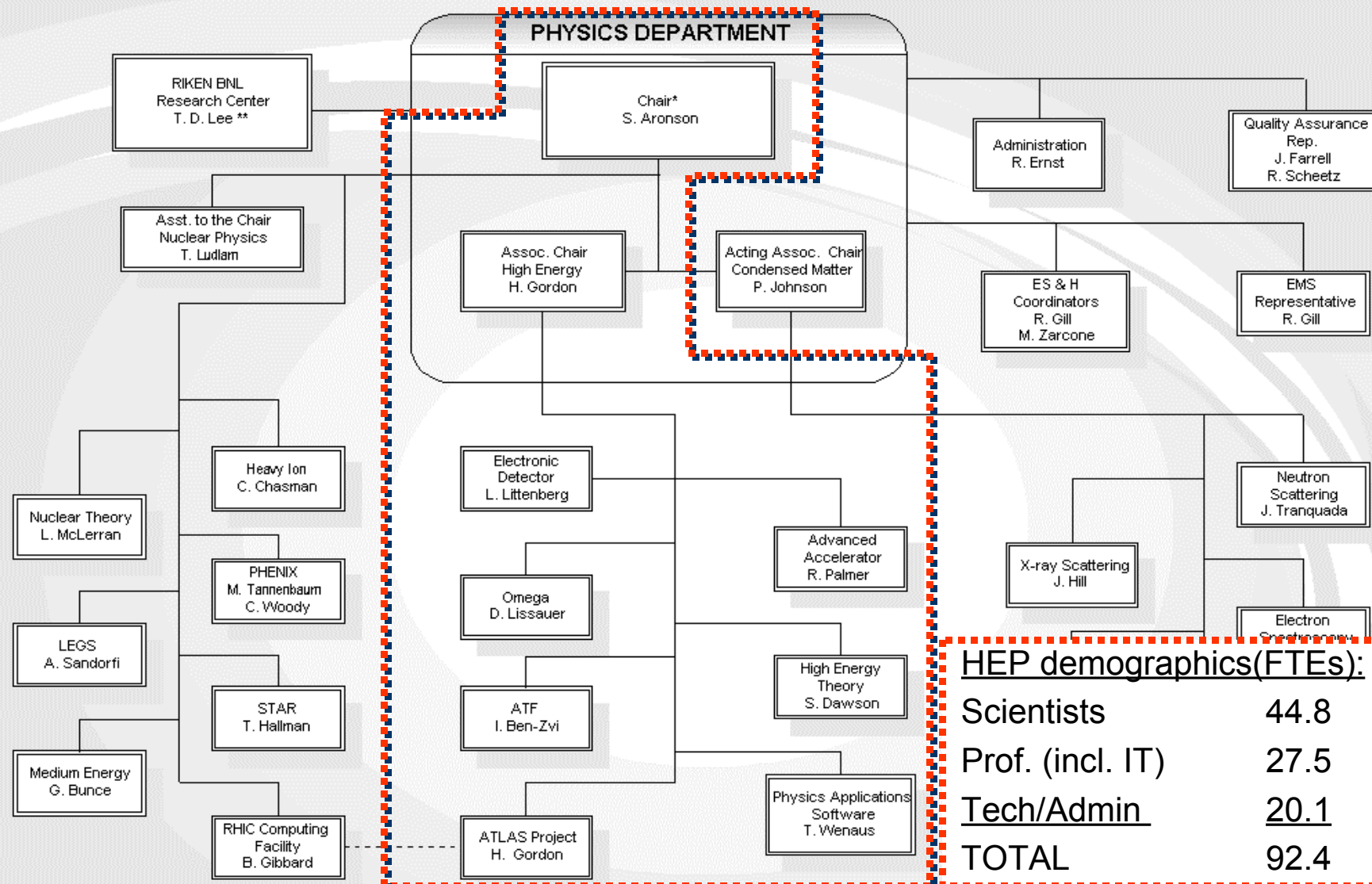
# Outline of this talk

- Structure and mission of the Physics Department
- Brief description of selected Physics Department Activities
  - Theory
  - D-Zero
  - RSVP (KOPIO, MECO)
  - $(g-2)_\mu$ , E949
  - MINOS
  - Advanced Accelerator development
  - Accelerator Test Facility
  - Astrophysics initiative
- Budgets and Manpower
- Summary and Conclusions

# Summary

- The Physics Department has a strong program of forefront activities that is responsive to DOE research priorities in experimental and theoretical particle physics
- Physics Dept. has world-class efforts in accelerator and detector R&D deployed in support of ambitious new initiatives in HEP
- At present, HEP is in serious funding trouble in the Physics Dept. The base program and HEP Theory are losing staff and will continue to do so.
- BNL is committed to crafting a sustainable, prioritized HEP program that provides breadth and and is responsive to national and international priorities
- In the face of continuing budget cuts in the base program, this will become impossible to accomplish. **Critical skills, recruiting opportunities and physics advances are being lost**

# BNL Physics Department



## HEP demographics(FTEs):

Scientists	44.8
Prof. (incl. IT)	27.5
<u>Tech/Admin</u>	<u>20.1</u>
<b>TOTAL</b>	<b>92.4</b>

# HEP Mission of the BNL Physics Department

- Take leading roles in high energy experimental and theoretical research with major discovery potential, both at BNL and other labs
- Take on tasks naturally suited to a national laboratory while closely collaborating with university groups
- Develop new HEP initiatives and capabilities through detector and accelerator R&D
- Maintain strong alignment with DOE HEP goals & priorities

# BNL Theory Group

- Supports the BNL experimental program

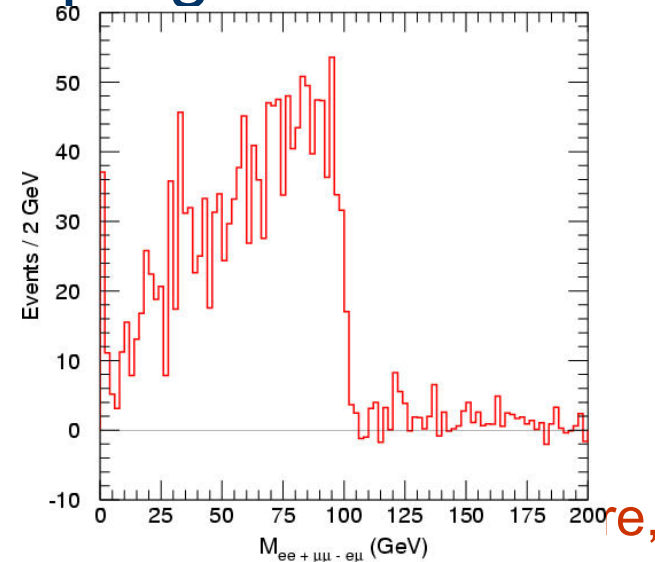
- ATLAS & D0 Collider Physics

- Serious SUSY simulations (Paige)
- Endpoints of lepton spectrum determine SUSY masses
  - **NEW**: Full GEANT simulation Full reconstruction
- QCD and Higgs Physics (Dawson, Kulesza) [Talk by Kilgore]

- Rare Decays

- **New results** on 2-loop electroweak contribution to  $(g-2)_\mu$  including strong interaction corrections (Marciano)

$$a_\mu^{EW} = 154(1)(2) \times 10^{-11}$$



# BNL Theory Group

- Theorists support the BNL experimental program
  - Spin physics at RHIC
    - How do we know what the polarization is? (Trueman)
  - High temperature QCD (Pisarski)
- BNL theorists advance long term US experimental program
  - Neutrino physics [Talk by Marciano]
  - Linear Collider Steering Committee (Dawson)
    - Lead LC Physics groups (Dawson, Marciano, Paige)
  - Underground Laboratory Steering Committee (Marciano)
  - B physics working group leader (Soni)
  - ATLAS SUSY working group leader (Paige)
- Lattice Gauge Theory naturally done at labs [Talks by Creutz & Soni]
  - RIKEN/BNL Collaboration (Berruto, Creutz, Soni)
  - **New:** Preliminary calculation of  $(g-2)_\mu$  on lattice (Blum)
  - Weak Matrix elements on lattice:

$$a_\mu^{had}(lattice) = 460(78) \times 10^{-11}$$

Theory scientific staff:  
Creutz  
Dawson  
Kilgore  
Marciano  
Paige  
Pisarski  
Soni  
Trueman  
Berruto  
Chen  
Kulesza

## BNL Theory Group

- Service to DOE:
  - P5, Facilities Committee (Marciano)
- Service to Community:
  - DPF chair (Dawson)
  - SciDAC EC (Creutz)
- Theory budget cuts a crisis:
  - Post-docs cut from **4** (FY02) to **3** (FY03) to **2** (FY04)
  - Summer Program cancelled (FY03)
  - Travel ~~severely restricted~~ **stopped**
  - Must reduce senior staff by 1 in FY03 and by another in FY04 to fit budget





# D0 experiment

Summary of Activities of the BNL group:

[talk by Jain]

- BNL group on D0 (5.4 FTEs):
  - V. Jain\*
  - S. Kahn
  - J. Kotcher
  - A. Patwa\*
  - S. Protopopescu\*
  - S. Snyder\*
  - A. Turcot\*
  - K. Yip
- Leadership Roles:
  - Manager of Run IIb Project (**Kotcher**)
  - Leader of Data Tier group (**Protopopescu**)
  - Co leader of Calorimeter and Preshower software development (**Turcot**)
  - Co leader of B-physics analysis group (**Jain**)

# D0

- Hardware and Software Contributions:
  - Commissioning FPS (**Patwa**)
  - Development of Online infrastructure software (**Snyder**)
  - Development of L1 Track Trigger Simulation software (**Jain**)
  - Software development for FPS (**Patwa**, **Protopopescu**, **Turcot**)
  - Development of Offline Calorimeter Software (**Kahn**, **Turcot**)
  - Development of Offline infrastructure and analysis software (**Jain**, **Protopopescu**, **Snyder**)
  - Coordinator of SAM (data storage/access system) shifts (**Yip**)
  - Member Trigger Board (**Turcot**)
  - Upgrade Management (**Kotcher**)
- Physics Analyses Activities:
  - -- High Energy Frontier:
    - Higgs Search (**Kahn**, **Patwa**, **Snyder**, **Turcot**)
    - SUSY search, tau channel (**Protopopescu**)
  - -- Flavor Physics (**Jain**, **Yip**)

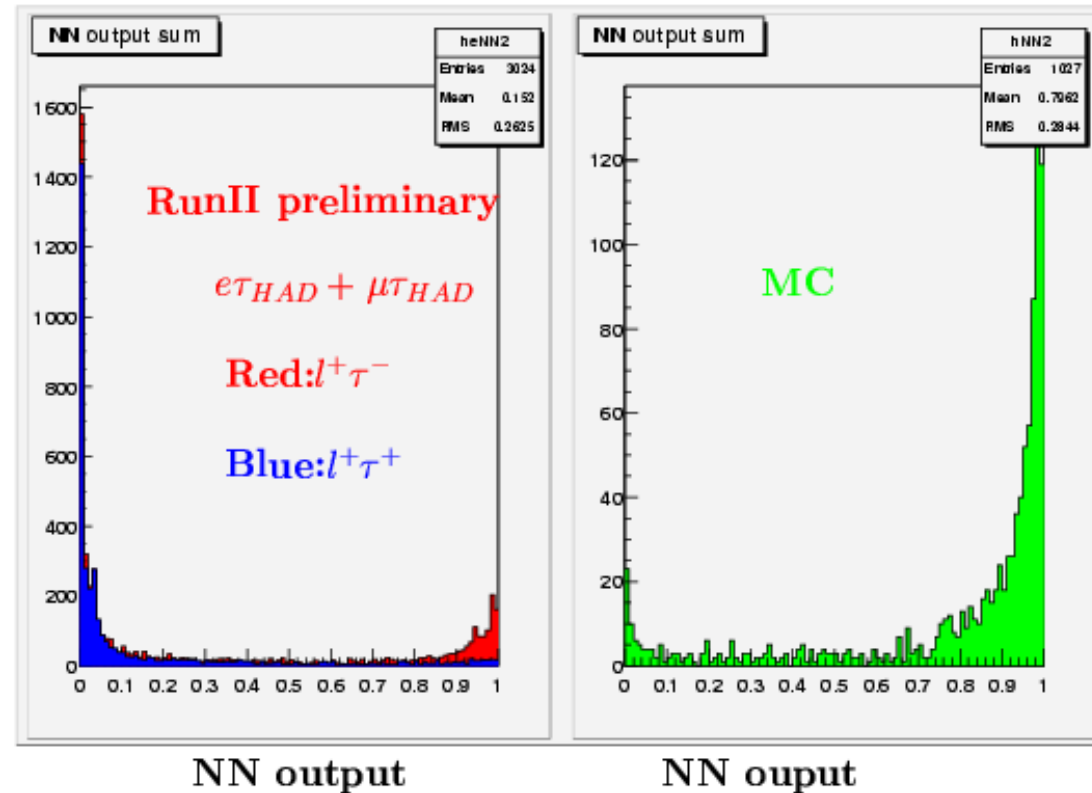
## $Z \rightarrow \tau\tau$ in RunII Data

# D0 analysis

- The D0 BNL Group is proposing to establish a **D0 Regional Analysis Center**, by expanding the RHIC and ATLAS Computing Facilities. Vivek Jain will discuss this in his talk today.

Select events with good  $e$  and  $\mu$  and 1-prong  $\tau$  candidates.

Use Neural Network to identify  $\tau$ 's.



NN uses calorimeter and track energy distributions as inputs



# Run II Physics Program: The Larger Picture

## 300 pb<sup>-1</sup>

- Improved  $m_t$  measurement
- High  $p_T$  jets constrain proton structure
- B Physics
- Searches beyond Run I sensitivity

## 2 fb<sup>-1</sup>

- Measure  $m_t$  ( $M_W$ ) to  $\pm 3$  GeV ( $\pm 15$  MeV)
- Directly exclude  $m_H = 115$  GeV
- Significant SUSY and SUSY Higgs searches
- B-physics: constrain the CKM matrix

## 5 fb<sup>-1</sup>

- $3\sigma$  Higgs signal @  $m_H = 115$  GeV
- exclude Higgs 115-125, 155-175 GeV
- exclude much of SUSY Higgs parameter space

## 15 fb<sup>-1</sup>

- $5\sigma$  Higgs signal @  $m_H = 115$  GeV
- $3\sigma$  Higgs signal  $m_H = 115$ -135, 150-175 GeV
- Ultimate precision for top, EW and B physics
- Ultimate reach for New Phenomena

Luminosity/Run	IIa	IIb
Integrated (fb <sup>-1</sup> )	2	10-15
Instantaneous (x10 <sup>32</sup> cm <sup>-2</sup> s <sup>-1</sup> )	1-2	2-4

**Replace Silicon Detector with rad-hard version**

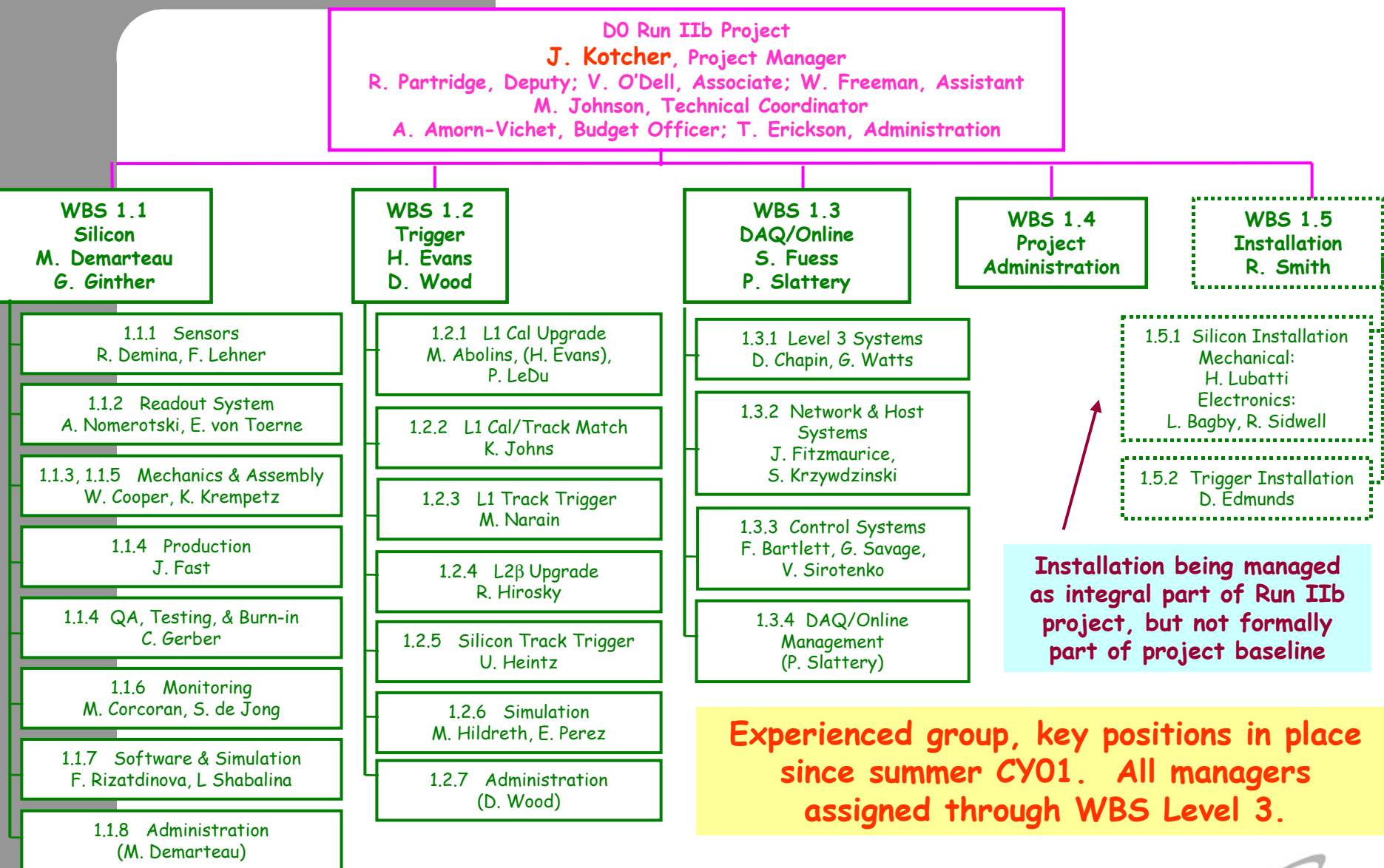
**Improve b-tagging performance**  
**Good pattern recognition over  $|\eta| < 2$**

**Upgrade Trigger**

**Mainly L1: increased functionality to contain rates and deadtime**  
**Incremental upgrades to L2, L3 and online system**



# Run IIb Project Organization





Shutdown begins March 30 '06  
Ready for beam October 25 '06

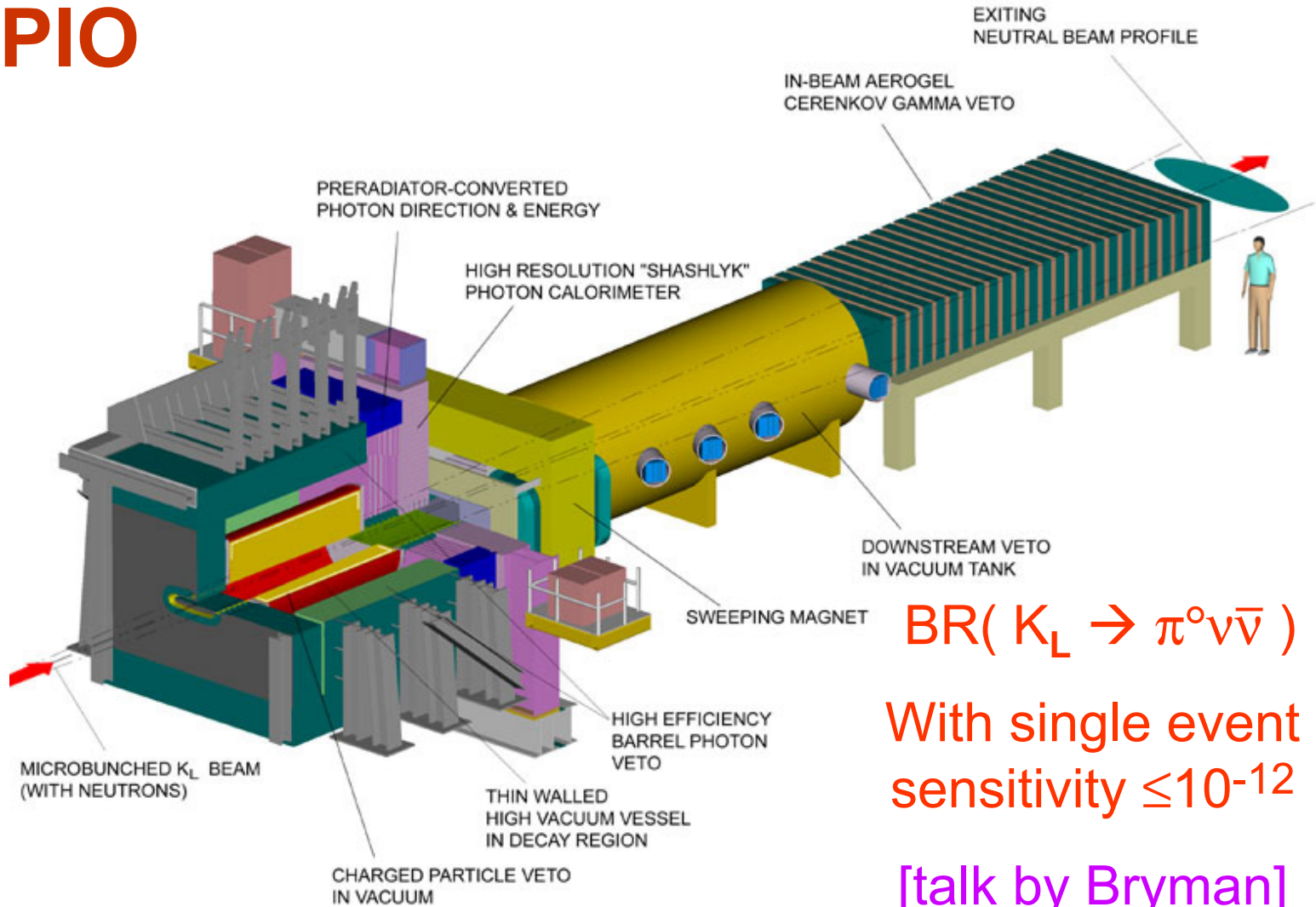
## DOE Level 1 Milestones

Milestone	DOE Level 1 Milestone Date
All silicon sensors delivered and tested	12/09/04
Online System Production and Testing Complete	10/07/05
Silicon stave production complete	12/22/05
Level 2 Trigger Production and Testing Complete	01/05/06
Level 1 Trigger Production and Testing Complete	01/10/06
Silicon ready to move to D0 Assembly Building	05/25/06
CD-4: DOE Approval of Project Closeout	11/06

# RSVP

- Two experiments with reach beyond the standard model
  - KOPIO ( $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$ ) and MECO ( $\mu\text{-}N \rightarrow e\text{-}N$ )
- NSF-funded construction (~\$150M) & operation (~\$12M/yr)
- Construction start in FY 2006; efforts under way to advance this to FY 2005
- DOE-HEP support of BNL scientific research staff is required to make KOPIO & MECO work

# KOPIO





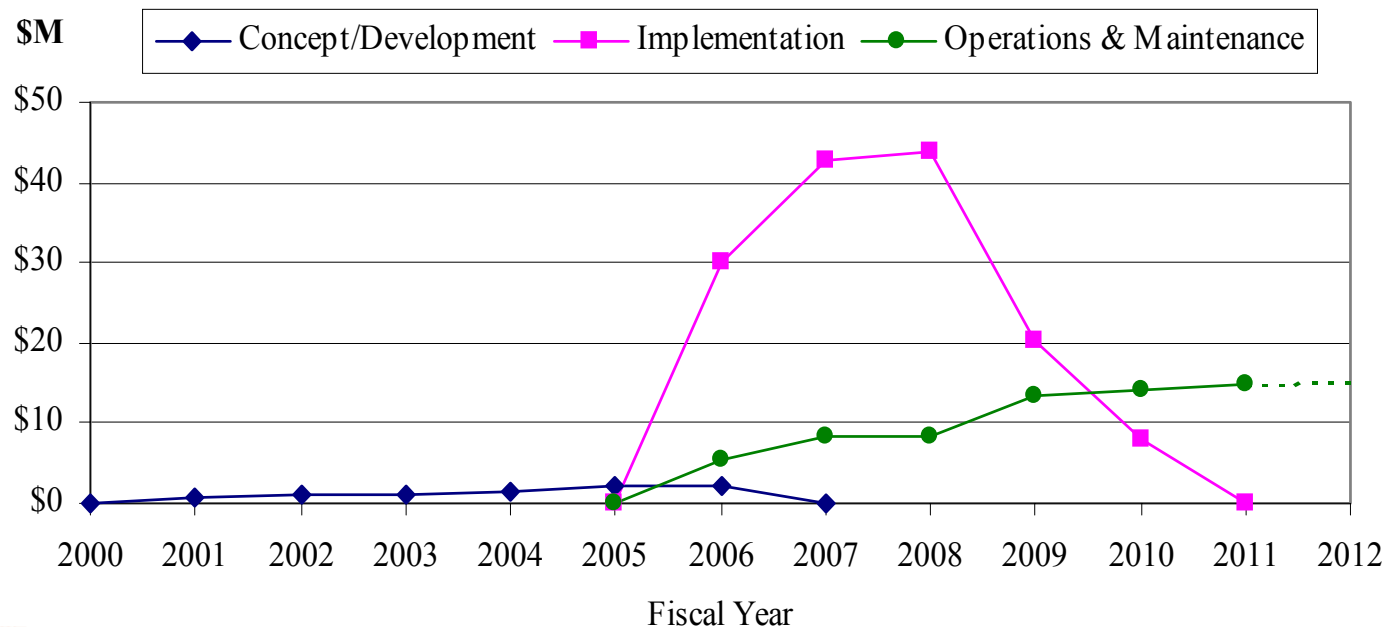
# KOPIO

- Current experimental upper limit for  $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$  branching ratio (BR) is  **$5.9 \times 10^{-7}$**  (KTEV)
- Theoretical upper bound using  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  events is  **$1.7 \times 10^{-9}$**
- KEK391a proposes to reach single event sensitivity of  **$3 \times 10^{-10}$**
- Standard Model predicts BR of  **$3 \times 10^{-11}$**
- KOPIO proposes to measure the BR with **40 events** at the Standard Model level; and with a single event sensitivity of below  **$10^{-12}$**
- KOPIO improvement over KTEV from
  - More acceptance (  $\times 5.6$  )
  - Predominant  $\pi^0$  decay (  $\times 83$  )
  - More decaying K's (  $\times 800$  )
- BNL group has long experience with rare decays and high efficiency  $\gamma$  vetoes

# KOPIO Status

- A 3-phase funding plan for KOPIO/RSVP appears in the FY04 NSF Budget Request for a FY06 capital start
- The NSF is likely to provide additional Concept/Development funds to both experiments as interim support

RSVP Funding, by Phase



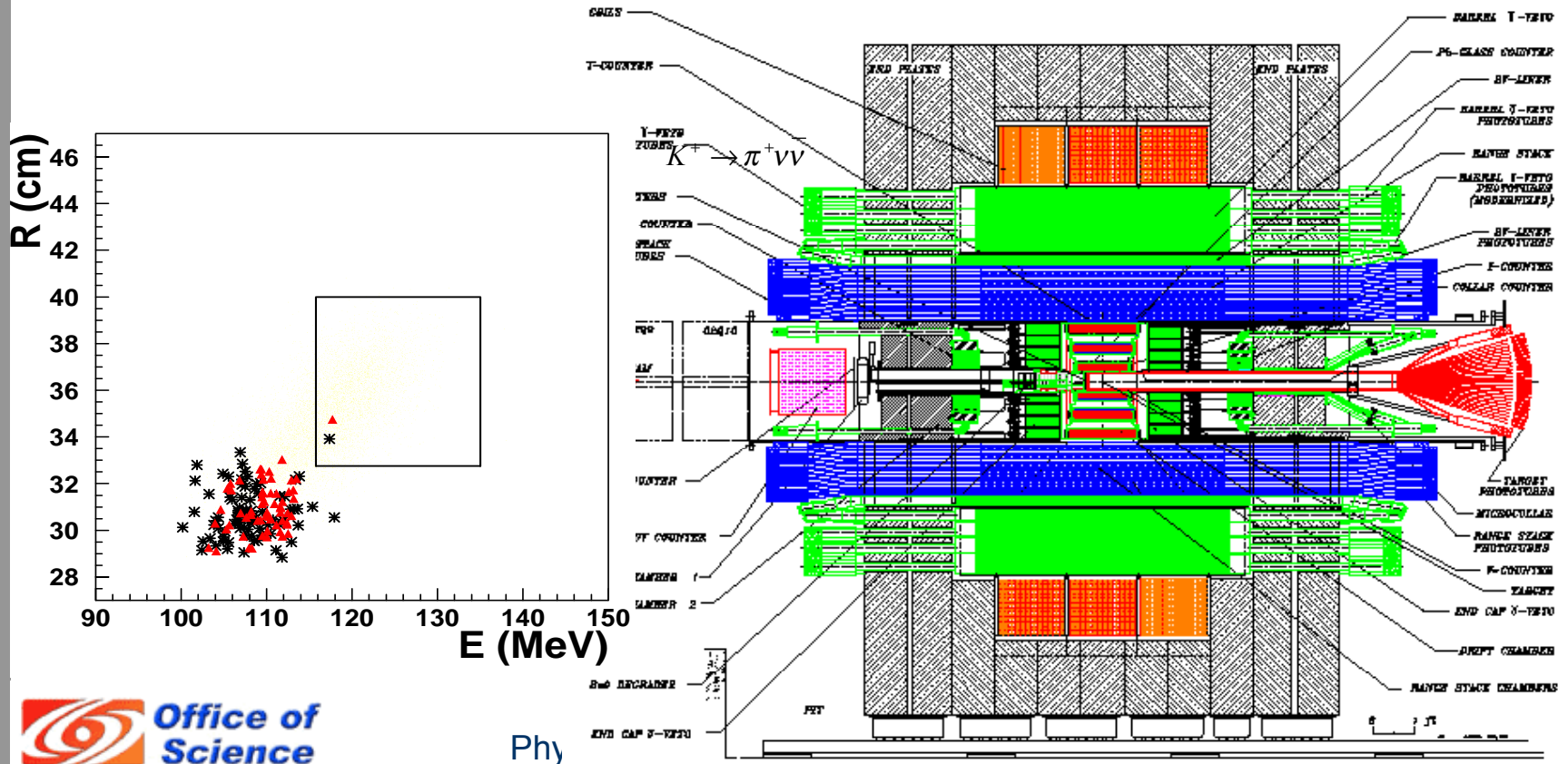
# KOPIO Status and Activities

- NSF Technical/Management Review (1/03):  
“The ... KOPIO roadmap ... is well thought out and provides a basis ... to bring KOPIO to construction readiness in a timely way for FY2004 construction.”
- Broad range of activities centered at BNL:
  - Physics + C-AD verified essential **micro-bunching of beam**
  - Canadian grant of \$5M to upgrade AGS intensity for KOPIO
  - Integration design effort focused on **thin wall decay vacuum sys**
  - Significant effort on GEANT **simulation of beam & detector**
  - **DAQ responsibility** & participation in trigger design
  - Participating in development of **downstream veto system**

KOPIO Scientific  
Staff:  
Diwan  
Frank  
Jaffe  
Kettell  
Li  
Littenberg  
Redlinger  
Sivertz  
**Scarlett**

# E949

Of the four 'golden modes' that provide unambiguous determination of fundamental CKM parameters, two have been approved to run at BNL:  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  and  $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$  [talk by Bryman]

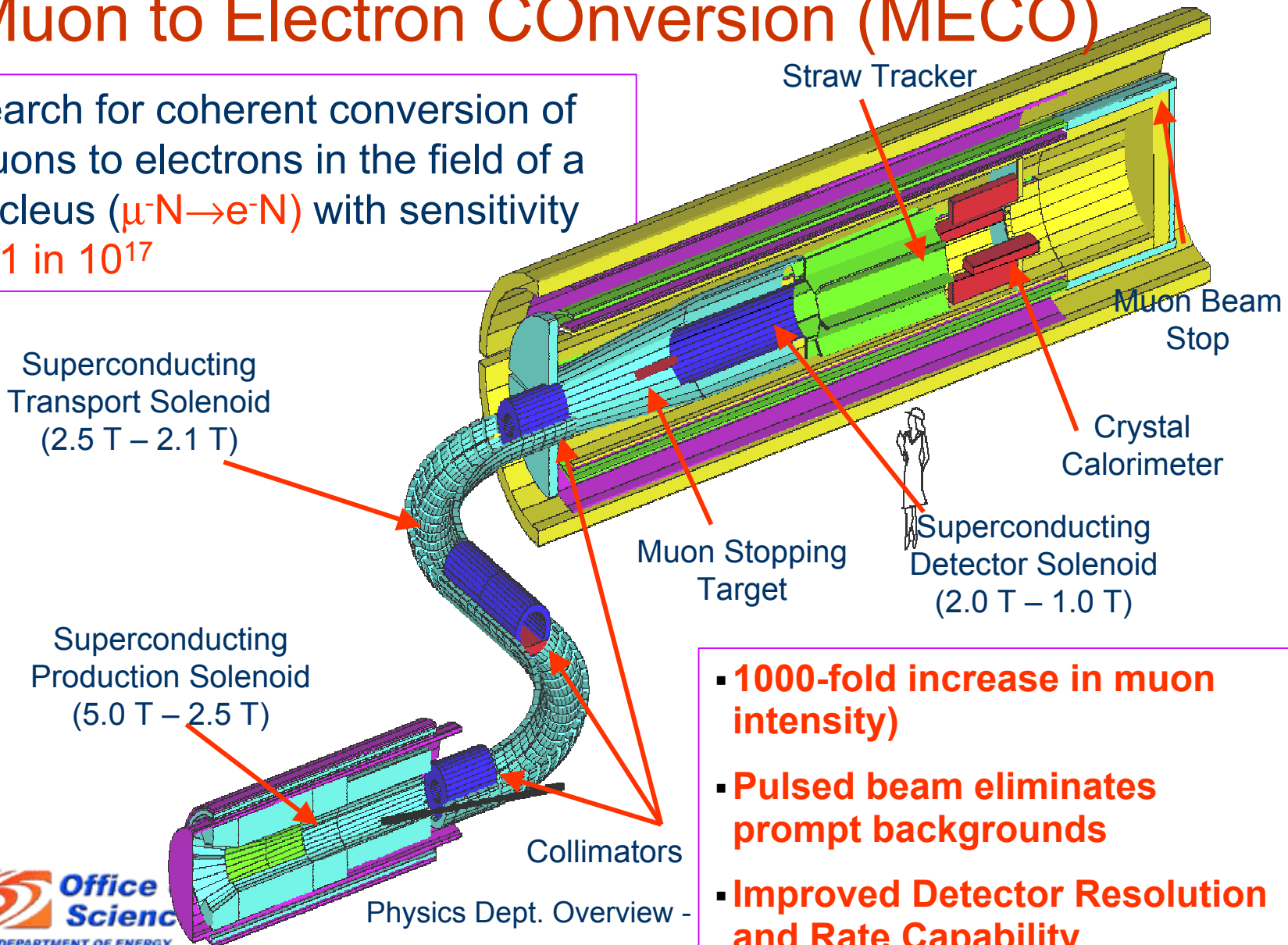


## E949

- $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  (E949) was approved to run by DOE in 99\*\*.
  - Endorsed by the national and international HEP community
- $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$  (KOPIO) was approved by NSF for construction start in FY 2006
  - \*\*Currently seeking NSF approval to run E949
- BNL is recognized internationally as the center of expertise on  $K \rightarrow \pi \nu \bar{\nu}$  and it is the responsibility of DOE to assure that this expertise is not further compromised by additional research funding cuts.
- DOE's investment in E787/E949 has paid dividends in the discovery of  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  and is poised to make a significant impact on our understanding of CP violation.

# Muon to Electron CONversion (MECO)

Search for coherent conversion of muons to electrons in the field of a nucleus ( $\mu^- N \rightarrow e^- N$ ) with sensitivity of **1 in  $10^{17}$**



- **1000-fold increase in muon intensity)**
- **Pulsed beam eliminates prompt backgrounds**
- **Improved Detector Resolution and Rate Capability**

# MECO

[talk by Morse]

- $(\mu\text{-}N \rightarrow e\text{-}N)$  with sensitivity of 1 in  $10^{17}$  – the best bet for discovering muon and electron number violation in the charged sector
  - This process is predicted or allowed at or above the experimental sensitivity in many scenarios for physics beyond the Standard Model.
  - Approved for funding by the NSF in the MREFC program as part of RSVP
  - Currently scheduled for construction project funding starting FY06
  - Unique capabilities of the AGS to make the world's most intense muon beam
  - Operations will be fully supported by the NSF

# BNL Contributions to MECO

- Conceptual design of AGS modifications (M. Brennan, accel. phys.)
- Conceptual design work on proton beam (K. Brown, accel. phys.)
- Preliminary p-beam and exp. layout, cost & schedule (D. Phillips, eng.)
- Consulting on magnet design, other issues (W. Meng, liaison phys.)
- Detailed conceptual design of vacuum separation window (D. Weiss)
- Simulation of radiation levels (P. Yamin)
- Activation calculations (A. Stevens)
- Contributions to mag. design - cryogenic, safety interfaces (M. Iarocci)
- Detector mounting system (W. Leonhardt)
- Muon beamline oversight (W. Morse)
- Magnet procurement expertise (D. Dale)

## MECO Scientific Staff:

Brown  
Brennan  
Greene  
Jia  
Marciano  
Morse  
Semertzidis  
Yamin



# Current MECO Status

## Scientific approval status:

- Approved by BNL and by the NSF through the level of the Director
- Approved by the National Science Board for a MRE Grant
- Endorsed by the HEPAP Subpanel

## Technical and management review status:

- Positively reviewed by multiple NSF and Laboratory appointed panels
- Magnet system positively reviewed by external expert committees appointed by MECO leadership

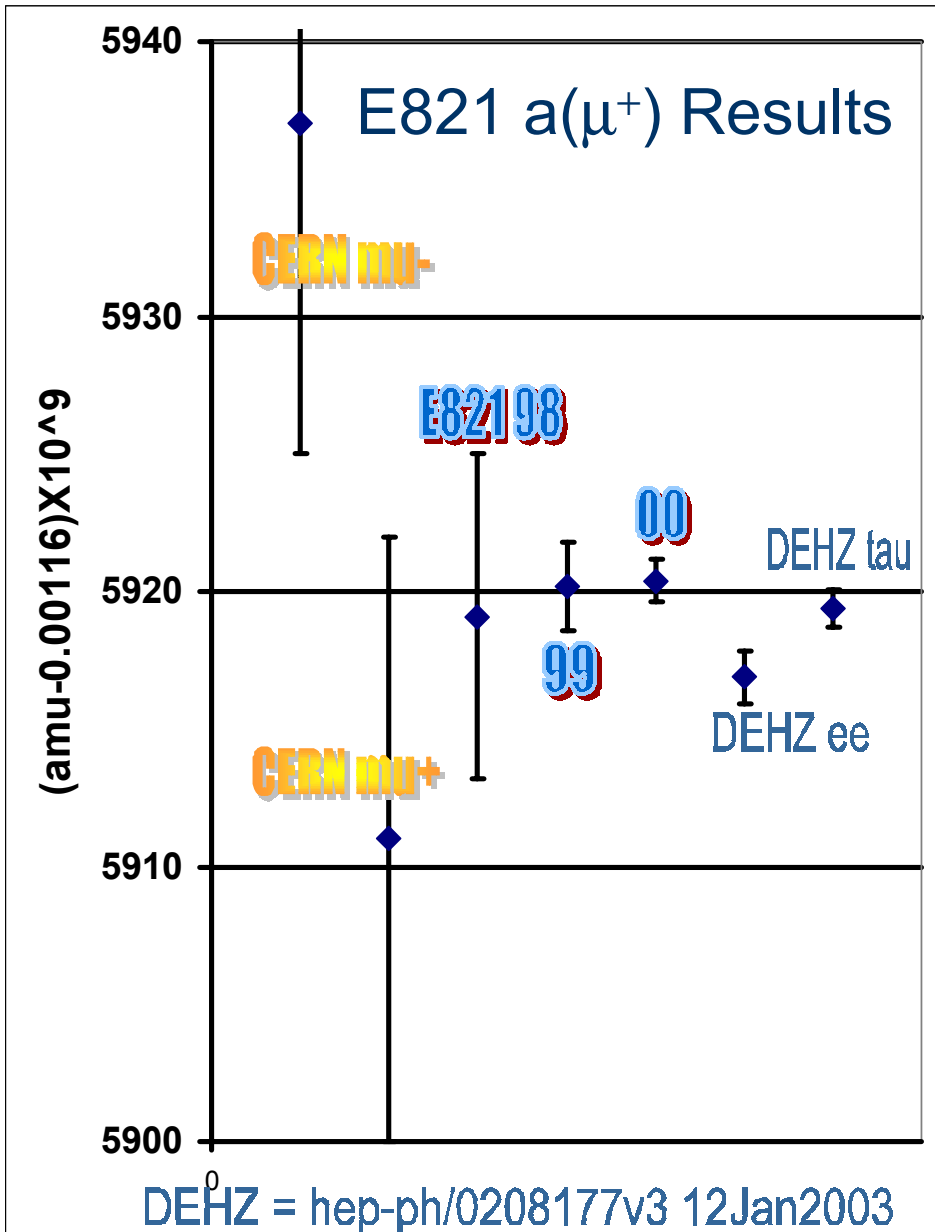
## Funding status:

- MECO is currently operating on two R&D grants for a total of \$2.1M
- Construction funding for RSVP appears in 2004 NSF budget submission to Congress for an FY06 start
- Additional project development funding is being discussed with NSF.

# Muon (g-2)

- **AGS E821** Precision Measurement of Muon (g-2)
- Boston, BNL, Cornell, Fairfield, Heidelberg, Illinois, Minnesota, Novosibirsk, Sci. Univ. Tokyo, KEK, Yale
- Goal is a measurement of the anomalous magnetic moment of the muon at the 0.35 ppm level
  - a factor of 20 improvement over CERN experiment
  - sensitive to new physics (e.g. SUSY)

[talk by Morse]

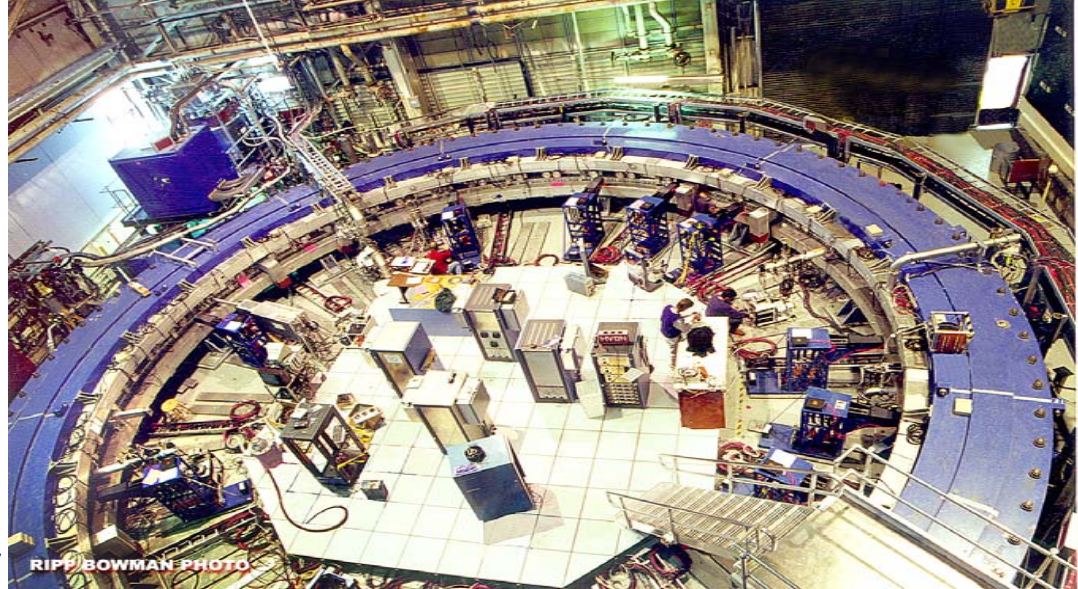


New radiative return  $e^+e^-$  data from KLOE and B factories.  
Calculate hadronic correction to  $a_\mu$  on the lattice.

# Muon (g-2)

## Plans

- Now analyzing 2001 run  $a(\mu^-)$  data.
  - Result early summer
- 4X improvement at AGS – possible NSF proposal
  - Larger inflector aperture, beam line emittance
  - SM hadronic contribution
- BNL team might participate in JPARC LOI January, 2003.
  - Lee Roberts spokesman.
  - 10X improvement at JPARC
    - 0.9MW (JPARC) vs. 0.15MW (AGS)
    - Larger inflector aperture, beam line emittance
    - SM hadronic contribution

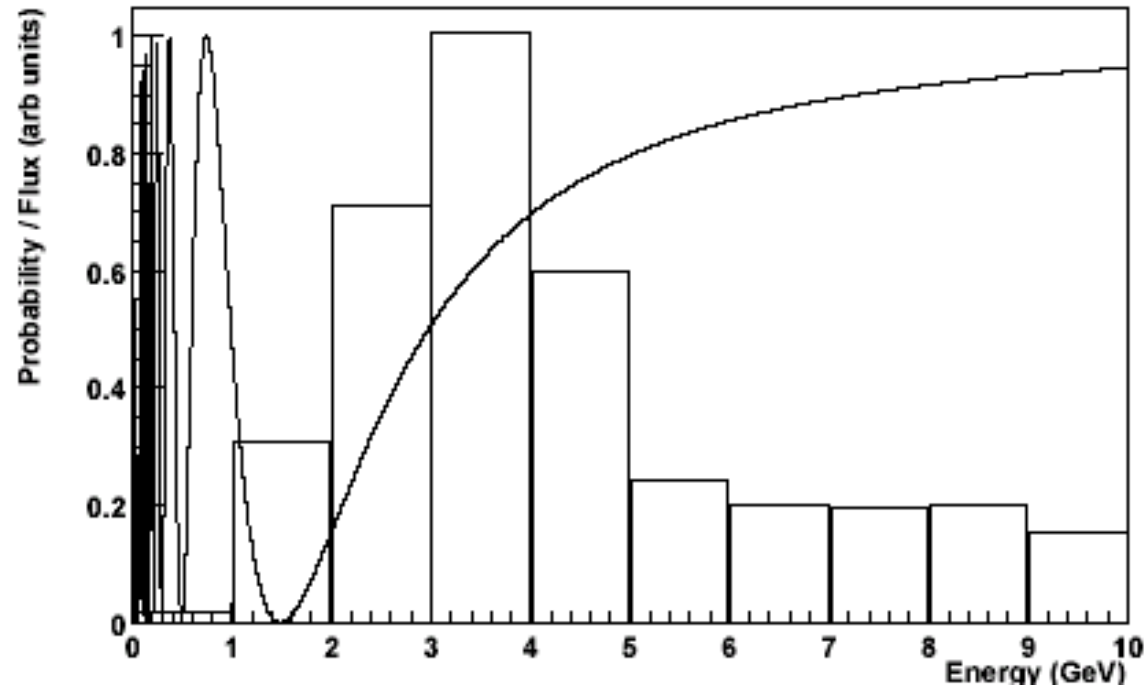


# Neutrino Physics - MINOS

- Very Long Baseline Oscillations [talk by Kirk]
- MINOS at Fermilab – Long baseline oscillations
- BNL Group contributions
  - **M. Diwan** is the co-convener of the  $\nu_\mu \rightarrow \nu_e$  analysis group
    - This will be one of the key measurements from MINOS
  - **B. Viren** is in charge of the event display package and of the software for online beam monitoring.
    - Viren has also made key contributions to the object-oriented software development
  - **BNL** developed the **beam monitoring detectors** in collaboration with Fermilab, Pittsburgh and Wisconsin
    - Publication: J. McDonald et al., NIM **A496** (2003) 293-304
  - **BNL Group** is studying possible **beam upgrades for NuMI** to create a better-tuned spectrum when oscillation parameters are better known.

# NuMI Beam Tuning

Oscillation probability and NuMI flux vs.  $E_\nu$



- Currently the first minimum is expected to be at 1.5 GeV for MINOS
- Unclear if MINOS can see the “Spectrum Dip”
  - Also not optimized for  $\nu_\mu \rightarrow \nu_e$
- Goal for beam optimization
  - Eliminate flux above 6 GeV
  - Increase flux below 1.5 GeV

# Advanced Accelerator Group

- Hg Jet Target Experiment
  - Run last year at  $\frac{1}{4}$  p intensity & no magnetic field
  - Progress in simulation
  - Design of test magnet
  - AGS run with full intensity and magnet in 05/06
- Design and Simulation of Neutrino Factory
  - Study 2 (at BNL site) in 2001
  - Progress on 6D Cooling Rings reducing cost
  - Progress on Fixed Field Alternating Gradient (FFAG) Acceleration reducing cost
  - Work towards lower cost Study 3
- Joined proposed international cooling experiment (MICE)
  - Design and Simulation

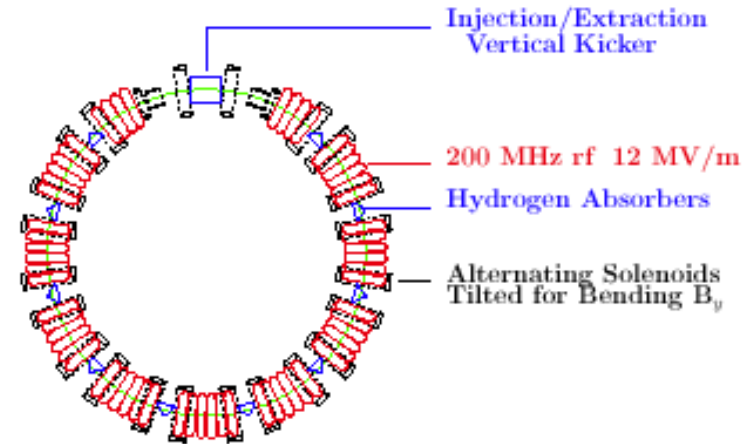
[talk by Palmer]



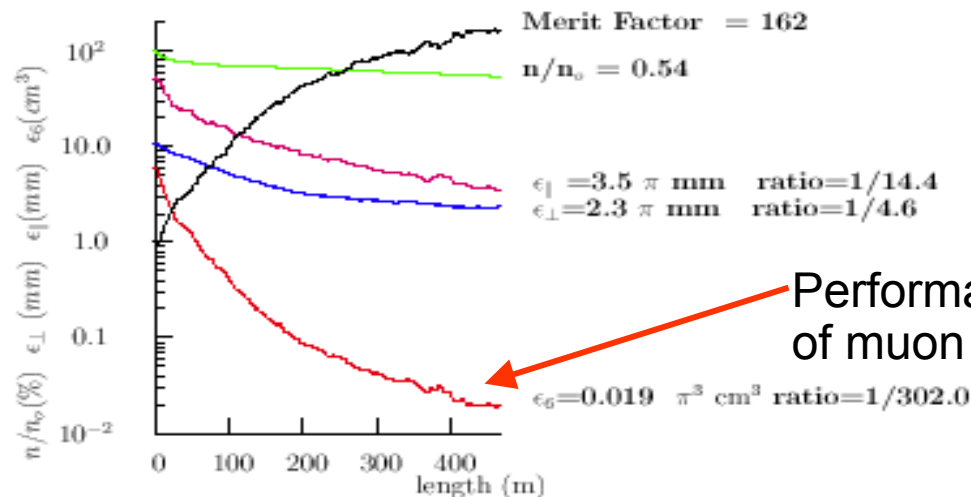
# Adv. Accel. Activities

## Neutrino Factory simulations

- studying lower cost alternatives
  - e.g. muon ring coolers
  - use ionization cooling (energy loss + reacceleration)
- 3 ring families under study
- wedge absorbers give longitudinal cooling



RFOFO cooling ring with solenoid focusing



Performance: strong cooling of muon 6D emittance

# The BNL Accelerator Test Facility

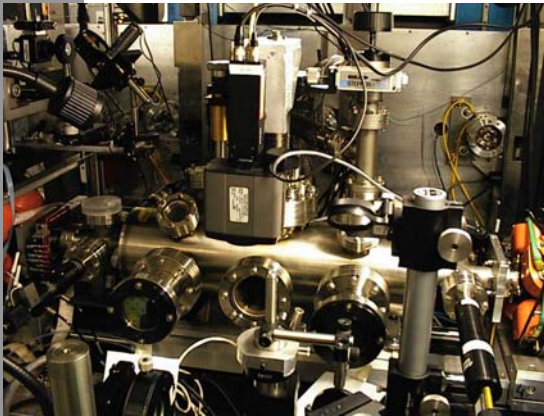
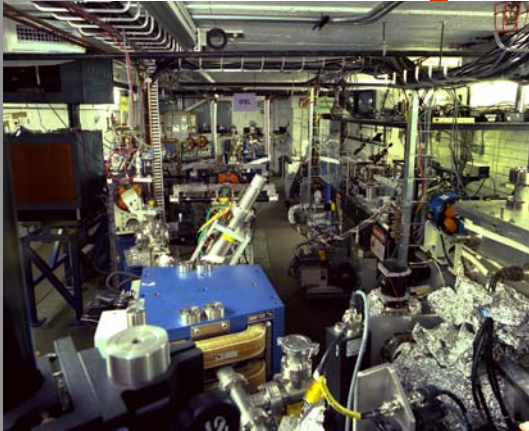
- Proposal-driven, advisory committee reviewed USER'S FACILITY for long-term R&D in Accelerator and Beam Physics.
- Serving National Labs, universities and industry.
- Contributes to Graduate Education in Beam Physics.
- From last year's review: "...ATF continuous its tradition of carrying out excellent research... providing an excellent training ground for many young accelerator physicists."

[talk by Ben-Zvi]

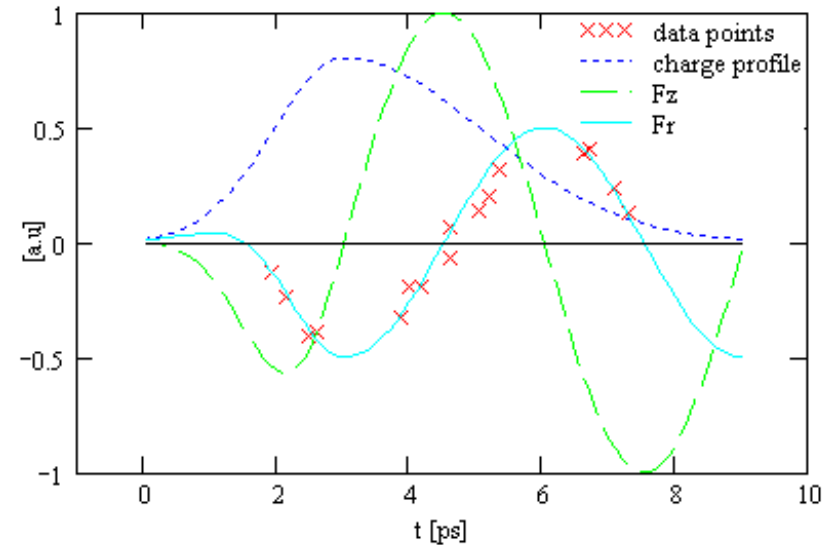
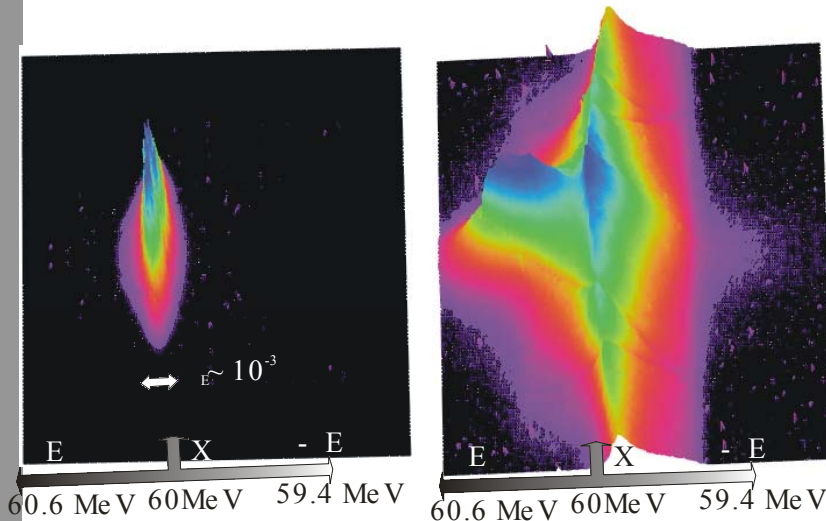
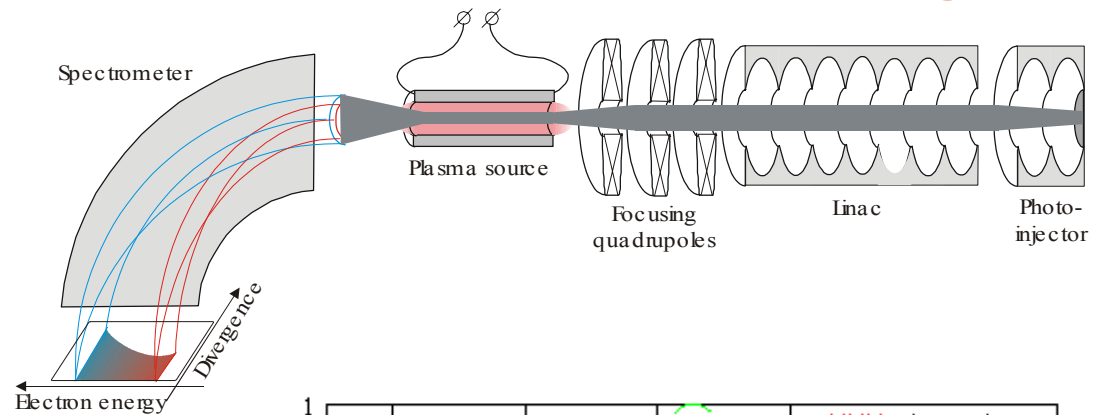
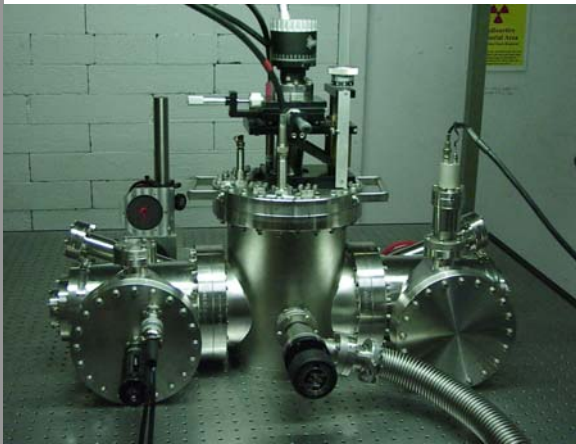
ATF Scientific Staff:  
Ben-Zvi  
Pogorelsky  
Wantanabe  
Yakimenko  
Deng



## ATF Experiment Hall: A small but extremely complex facility.



# Recent result: Observation of Plasma Wake focusing



# Astrophysics

- The BNL Physics Department is interested in adding astrophysics to its portfolio of activities
  - Good fit with mission, complementary to ongoing HENP physics
    - Energy frontier, BSM physics; early universe studies at RHIC
  - Applications to astrophysics of Instrumentation Division expertise
    - Si pixel detectors, low noise electronics
- Discussions at an early (but enthusiastic) stage
  - Effort on LSST – multi-gigapixel focal plane detector
  - Possible joint effort with other DOE HEP labs, could lead to proposal to DOE
  - Goal for BNL Physics would be a research group as well as hardware contribution.
  - BNL also has a high performance data storage/analysis capability (RCF/ACF)
- Other options open for exploration

# LSST

- Large Synoptic Survey Telescope
  - Ground-based facility
  - 8.4 meter, 7 square-degree field, synoptic survey telescope. The product of collecting area and field of view will be 20 times more powerful than any observatory now operating or under construction.
  - The heart of the 2.3 Gpixel camera will be an array of imager modules with  $10\mu\text{m}$  pixels.
  - Once each month LSST will survey up to 14,000  $\text{deg}^2$  of the sky with many  $\sim 10$  sec exposures.
  - Over time LSST will survey 30,000  $\text{deg}^2$  deeply in multiple bandpasses, enabling innovative investigations ranging from galactic structure to cosmology.



**syn·op·tic**  
Affording a general view of a whole; relating to or displaying conditions (as of the atmosphere or weather) as they exist simultaneously over a broad area

# Physics Operating Budgets

B&R Classification	FY 2002	FY 2003	PRES. FY 2004	REQUEST FY 2004	Proposed FY 2005
KA110102 [Research]	7.30	8.26	6.77	8.53	8.99
KA110102 [Research Capital]	0.99	0.00	0.99	1.42	1.28
KA1102043 [LHC ATLAS]	2.00	1.20	0.60	0.60	0.60
KA1102043 [LHC ATLAS MIE 01 CA]	4.80	3.18	2.00	2.00	2.07
KA1102051 [LHC ATLAS Computing ]	1.20	1.31	0.68	2.75	3.69
KA1102052 [LHC Experimental Support]	0.20	0.40	0.00	2.23	5.58
KA1401020 [Theoretical Physics]	2.50	2.35	2.27	2.65	2.75
KA1401030 [SciDAC]			0.16	0.16	0.16
KA1501020 [ Accelerator Science]	0.75	1.83	2.14	2.26	2.28
KA1501020 [ATF Capital]		0.20	0.19	0.30	0.30
KA1502030 [Muon Collider R&D ]	1.50	0.95	0.96	1.30	1.34
KA1502030 [Muon Collider Capital]	0.30	0.10	0.00	0.00	0.00
KA1503020 [Other Technology R&D]	0.94	0.93	0.87	1.11	1.15
<b>Total Ops</b>	<b>16.39</b>	<b>17.23</b>	<b>14.45</b>	<b>21.59</b>	<b>26.54</b>
<b>Total Capital</b>	<b>6.09</b>	<b>3.48</b>	<b>3.18</b>	<b>3.72</b>	<b>3.65</b>
<b>Total</b>	<b>22.48</b>	<b>20.71</b>	<b>17.63</b>	<b>25.31</b>	<b>30.19</b>
<b><u>Staff Levels (FTE's) TOTAL</u></b>					
Scientific	47.0	44.8	41.1	51.6	50.9
Professional	23.0	27.5	20.5	28.7	28.7
Tech/Admin.	22.0	20.1	19.5	20.3	20.3
Graduate Students	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>92.0</b>	<b>92.4</b>	<b>81.1</b>	<b>100.6</b>	<b>99.9</b>

Decrease from FY 2002 to FY 2003: FY 2003 contains 8 new FTEs (ATF group) ⇒ 8 FTE reduction (base + theory) so far



# Work Jeopardized by the FY 2003 Budget

- We have stopped hiring – no postdoc for D0 or ATLAS
- ATLAS responsibilities for Liquid Argon hardware and software are affected.
- Maintenance of a viable presence in MINOS
- Preparation of KOPIO, MECO
  - Quite counterproductive if we RIF scientists who understand the experiments and then the program goes ahead
- Final Analysis of the remaining g-2 data
- Analysis of the E949 data – quantity was of a similar sensitivity as E787
- Preparation of CKM
- We requested \$800k in February to retain the 3.5 FTE scientists to allow the program above. This was denied.
  - Lab commitment of \$350k is important but not sufficient. RIFs ongoing.

## FY04 President's Request compared to FY03:

- KA110102 - Proton Research - decreased by 10% (assuming 3.5% escalation of labor which dominates the budget).  $\Rightarrow$  **reduction of 3.5 FTEs**. This does not include the impact on other B&R codes.
- Allows for sub-optimal performance of:  
**ATLAS, D0, RSVP, MINOS, E949**
- The following would jeopardized or halted:  
**CKM, g-2, EDM**
- Annual performance goals in our major subprogram area:  
**ATLAS**
  - Would not affect the % completion of ATLAS
  - However, difficult to add the needed FTEs to ATLAS
  - Would be unable to proceed with the Physics Analysis Center

# FY04 Budget Discussion

- FY04 at **-2%** relative to President's Request
  - 2% in Research is one junior staff or 1.3 postdocs
  - Allows for sub-optimal performance of:
    - ATLAS, DO, RSVP, MINOS
  - Would result in the following impacts:
    - Curtailment of E949 analysis, in addition to (CKM, g-2, EDM, )
- FY04 at **+2%** relative to President's Request
  - Where would we put additional funding and what would benefits be?
    - ATLAS – hire needed staff; get prep for Research on track
  - There are the following Issues/Concerns/Change in Personnel/New Directions/etc
    - We want to add at least one staff member to the neutrino effort, to maintain a viable MINOS presence and to develop the Very Long Baseline Neutrino concept.



# FY05 Scenarios: Proton Research

- FY05 at **-10%** wrt FY04 President's Request: A further reduction of **4+ FTEs**
  - Allows for the following minimal performance:
    - ATLAS, D0, RSVP
  - Would result in the following impacts...
    - Drop one physics and one service topic from D0, halt MINOS, E949, CKM, g-2, EDM
- FY05 funding same as FY04 (**flat-flat**): A further reduction of **1+ FTEs**
  - Allows for the following minimal performance (delta with respect to -10% case)
    - ATLAS, D0, RSVP, MINOS,
  - Would result in the following impacts...
    - E949, CKM, g-2, EDM stopped

# FY05 Scenarios: Proton Research

- FY05 funding at **+2%** wrt FY04 Pres. Req.: A further reduction of **0.5<sup>+</sup> FTEs**
  - Allows for the following sub-optimal performance: (delta with respect to flat-flat)
    - ATLAS, D0, RSVP, E949
  - Would result in the following impacts...
    - CKM, g-2, EDM stopped
- Annual performance goals in our major subprogram areas: **ATLAS**
  - Construction progress would not be affected. ATLAS PAC staffing would lag.
- There are the following Issues/Concerns/New Directions/etc
  - ATLAS Physics Analysis Center
  - We want to add at least one staff member to maintain a viable MINOS presence and to develop the Very Long Baseline Neutrino concept.

# Summary

- The Physics Department has a strong program of forefront activities that is responsive to DOE research priorities in experimental and theoretical particle physics
- Physics Dept. has world-class efforts in accelerator and detector R&D deployed in support of ambitious new initiatives in HEP
- At present, HEP is in serious funding trouble in the Physics Dept. The base program and HEP Theory are losing staff and will continue to do so.
- BNL is committed to crafting a sustainable, prioritized HEP program that provides breadth and and is responsive to national and international priorities
- In the face of continuing budget cuts in the base program, this will become impossible to accomplish. **Critical skills, recruiting opportunities and physics advances are being lost**